DOCUMENT RESUME

ED 256 966 CE 041 593

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TITLE U.S. Science and Technology--Its Impact on Trade and Industry Training.
PUB DATE 4 Dec 83
NOTE 13p.; Paper presented at the Annual Convention of the American Vocational Association (Anaheim, CA December 4, 1983).
PUB TYPE Viewpoints (120) -- Speeches/Conference Papers (150)

EDRS PRICE MF01/PC01 Plus Postage.
DESCRIPTORS Adult Vocational Education; Dislocated Workers; *Educational Improvement; *Education Work Relationship; Industry; Job Skills; *Job Training; Postsecondary Education; Relevance (Education); *Retraining; School Business Relationship; School Role; Secondary Education; *Technological Advancement; *Vocational Education

ABSTRACT

Vocational education must train students in a way that capitalizes on their potential while preparing them with the skills needed for the jobs being created through advances in science and technology. The impact of technological change has been to challenge education to ease the transition of displaced workers and to accommodate entries. State-of-the-art design and manufacturing systems that have influenced industry include computers, fiber optics, lasers, and robotics. Industry needs personnel with a basic, underlying structure of skills; specialized training; and the flexibility to learn new skills. Vocational education will serve young people and also workers who need a shorter, more focused period of retraining. High schools should narrow nonacademic instruction to a few well-chosen basic courses and leave more advanced training to full-time trade schools or technical institutes. Three conclusions can be drawn from a recent evaluation of vocational programs: vocational education is conferred a lower status than academic education, provision of vocational education is as important as preparation of students for college, and the variety in vocational education is an asset and a drawback. Reforms should include national program standards, program coordination, and industry involvement. (YLB)

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U.S. SCIENCE AND TECHNOLOGY –

ITS IMPACT ON TRADE AND INDUSTRY TRAINING

Remarks by
ALFRED W. PELLETIER
Chairman of the Board
Mack Trucks, Inc.
at the
American Vocational Association
National Annual Convention
Anaheim, California
December 4, 1983

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Alfred W. Pelletier

Alfred W. Pelletier is no stranger to the subject of vocational education. A native of Toronto, Ontario, Canada, he attended the Danforth Technical School and began his career with the Toronto Transportation Commission in 1939 as an apprentice mechanic. In 1941 he volunteered for service in the Royal Canadian Navy, and following his release from active duty in 1945, he rejoined the Toronto Transportation Commission as a journeyman mechanic, and was subsequently promoted to assistant shop foreman.

In 1952 Pelletier began his association with Mack Trucks, Inc., joining the company's Canadian subsidiary — now known as Mack Canada Inc. — as a shop foreman in Toronto. He was promoted to service manager in 1954, and in 1960 became overall Canadian service manager. He continued to rise through the organization in service and sales positions over the decade that followed. In 1970, he was appointed general manager of Mack Canada, and became its president in 1974.

You are all well aware of the widely publicized report of the National Commission on Excellence in Education, *A Nation At Risk*. This and other contemporary evaluations which I will mention shortly have provoked an uproar across this nation about public schools and professional educators. And it has happened before, witness the post-Sputnik era of the late 1950's. However, this time the uproar has been touched off in large part by professional educators themselves, which must be considered a very positive sign. Indeed, the current media attention and questioning atmosphere throughout education presents one of the best opportunities in years to seize the momentum and actually initiate some dramatic change on the issues before us. Often we chastise the media, accusing it of beating a subject to death. But when a topic receives enough attention, people finally become aware and interested. This exposure can work for us as we stress the changes that must occur in both academic and vocational education. But our objectives must embody a careful, long-term reorientation of American education, not hysterical charge for the sake of change. This will decide the difference between a more effective system that capitalizes on student potential and the real-world marketplace on one hand, or on the other hand, the educational equivalent of "The Day After."

I would judge that most Americans simply take our public school system for granted. Some accept it, others do not. Historically, at least until the latter half of the 19th century, education was a personal or family responsibility. And today, many still treat it as such, with a heavy emphasis on private and parochial schools. The government just wasn't involved to any substantial degree,

except for eliminating child labor, until the 1950's and 1960's, when federal aid to education blossomed, along with thousands of large, comprehensive high schools and various types of vocational institutions. These are precisely the establishments indicated most often in "A Nation At Risk" as contributing to the "rising tide of mediocrity."

Similarly, most Americans have long taken our postwar industrial preeminence for granted, and of course, this concept has also been severely shaken.

The issues of industrial restructuring and educational reorientation are profoundly interrelated, given the obvious effects each has on the other. Since the 1960's, a gradual force has been at work in this country, slowly unravelling key segments of our domestic economy and eroding our ability to compete in the global marketplace. For too long we viewed our economy as a sovereign island, believing that we could do virtually whatever we wished as long as it was good for *us* in the short term. At the same time, other nations, particularly Japan and many of the developing third world countries were rapidly building up their economies and entering into vigorous competition with established trading powers.

During this period, our government pursued a hodgepodge of stop-and-go economic policies which resulted in high inflation, and all but destroyed industry's ability to plan and prosper. This overall "levelling" effect has brought America into line with other nations — and has destroyed the advantages, real or imagined, that formerly made things seem so easy.

The key to understanding the magnitude of this changing lies in realizing that the recession from which we are now emerging

is not just another business cycle. We foresee no appreciable return to "normalcy" as we have perceived it through traditional business careers. And those who fail to recognize this reality risk their futures, whether they lie in business or education. Likewise, many of the casualties of this global economic transformation must accept a major change in their lives, because relatively few of the workers laid off in the past four years will be rehired into the same fields, regardless of how strongly the economy recovers. Wrenching change, especially affecting younger workers, is the price exacted by years of poor planning and living beyond our means.

The impact of technological change will only hasten this process, and we will likely spend the rest of the eighties thrashing out answers to some very basic questions: How will our economy absorb the displaced? How will we accommodate new entries?

We cannot alter the forces producing this change, and so we have this contemporary challenge for education of all types — easing this unavoidable transition, helping citizens find a productive role in society, preserving their self-sufficiency and human dignity.

Before moving into a specific discussion regarding my observations and recommendations on the present state and future of vocational education, I would like to use my company and industry as a "microcosm" of sorts to illustrate the impact of emerging technology on vocational training. I believe this will help amplify my point that vocational education — indeed, public education in general — must be exposed to the same forces that are making businesses more productive contributors to our society: namely, high standards, incentives, and competition.

The advances of technology have brought us a long way, but if one were to quantify present technology and compare it to what is to come, it would rate slightly above the stone axe.

For example, except for improvements in the wear resistance of cutting tools, much material shaping is performed using principles of the last century and before. We have made dramatic improvements in speed, accuracy, and efficiency, but 80 percent of what we do in a typical heavy-duty truck plant today would still be recognized by Eli Whitney.

At Mack, we have long recognized the need to keep abreast of the latest developments. The company not willing to do so will not survive in our intensely competitive marketplace. We have installed a number of new systems, among them: computer-aided design, numerically and computer-controlled machine tools; computer-based inventory and production control systems; sophisticated energy and environmental control systems; and computerized accounting, purchasing, payroll, and other information processing procedures.

We maintain a full-time task force charged with implementing a much higher degree of computer assist to our product design, testing, and manufacturing processes. The systems presently available promise a quantum leap in our ability to improve our product and build greater efficiencies into our operations. While the heavy-duty truck industry is not nearly as automated as the automobile segment, developments on the horizon will move us into an entirely new era, which, in essence, has already begun.

For instance, our latest product, introduced just last year, utilizes a composite cab constructed of high-strength fiberglass

compounds, with an exterior shape refined in the Boeing/Vertol wind tunnel.

Looking ahead, technological forecasting has a long history, and the only generality that can be made by the layman is that most "seers" of yesteryear were either too conservative, too fanciful, or totally off in left field. Technology tends to take off at unpredictable velocities and in unexpected directions. Even the most brilliant in their specialties often made grossly inaccurate predictions.

In 1925, R. E. Olds sold out his interest in the automotive industry, stating that "the field holds no more interest for me because the motor car has reached the ultimate in design and technology, and I wish to look for new fields to conquer."

Thomas Edison once remarked that no one would steal his phonograph because it had absolutely no commercial value.

Lee DeForest, the inventor of the vacuum tube and, more than anyone, the father of electronics, said in 1926 that he considered television to be technically feasible, but financially and commercially impossible.

These conservative prophets did not understand the self-energizing momentum of technology and its exponential spread.

In the late 1940's, we were deluged with fanciful predictions that the millennium was just around the corner. All of our needs would soon be provided to excess by a totally electronic, automated, and atomically-powered world. All that remained would be sufficient means to keep people occupied and entertained.

As you can imagine, too literal an acceptance of "futurizing" always invites error. We must not ignore the processes of designing, constructing, and maintaining such complex systems. And we cannot ignore

Eric Hoffer's criteria of "where do they keep the broom," to which we might add, "and who pushes it."

The purpose of such illustrations is to caution against simplistic statements and simplistic solutions. New technology will surely *eliminate* many jobs. But it will *create* many others. New technology and a changing economy will permanently recast certain industries, eliminating some segments. But it will also assist, by application, many other segments in becoming more competitive and more adaptable to change.

I know that my industry must take advantage of "state of the art" design and manufacturing systems as they become available, and I will address several that have already had an impact.

Naturally the biggest influence has been computers. Beyond the obvious and familiar aspects of the computerized office, computer aided design ("CAD") has created a revolution in the design, testing, and documentation of new products. Drafting will be one of the next major areas to undergo a transformation, as computer-generated graphics replace boards and mechanical instruments.

Evaluations such as strain tests on components are increasingly handled by technicians, rather than the engineers, who develop the tests and make decisions. I might add that it is far more difficult for us to find well-trained technicians than entry-level engineers.

A further extension of "CAD" is "CAM" — computer aided manufacturing, wherein production equipment is selected, prepared, and automatically guided through specific processes, all by central computer control. This opens up an entire spectrum, involving an interface with other machines, robots, unmanned transportation systems that direct

and move in-process material through the plant until it is a finished part in a warehouse. Even then the computer can direct the activities of systems that select parts from stock for shipment to customers or assembly operations, as well as trigger a re-order to maintain a desired inventory. Such systems are already in use in varying degrees throughout the industry. The same computer can also signal maintenance requirements on its attendant machinery.

On-board computers will soon become a common component on heavy-duty trucks — they already exist in home appliances and automobiles. They will handle functions such as fuel injection, pollution control systems, speed control, trip records, diagnostics, safety and preventive maintenance, and much more. The possibilities are almost limitless.

Fiber optics, presently in rather limited use throughout the truck industry, hold great possibilities for applications in communications and interfacing of systems. Their value has already been proved extensively in telecommunications and other so-called "high tech" industries.

Lasers, once utilized only in laboratories and for highly sophisticated purposes, are now moving into the mainstream as an important tool. Although they presently have certain limitations in durability and power, lasers will surely become a clean, quiet, highly accurate means of shaping materials. They will also find applications in communications, data storage and retrieval, welding, and burning parts from sheet metal — replacing some torch and press operations. Lasers have already been proven in years of application in medicine, aerospace and other fields. Our present laser use in the areas of parts inspection, machinery

adjustment, and wheel alignment merely scratches the surface.

Robotics is another highly visible, highly publicized area of future development, closely allied with the computers that make them possible. Their great advantage lies in performing tasks in hazardous or unpleasant environments, as well as those that are highly repetitive and demand a high degree of speed and accuracy. Automakers around the world have poured billions into robotics over the past few years, handling welding operations, painting, testing, with much more to come. At Mack, we are very lightly into robotics due to the custom nature of our product, with very few orders exactly alike. We do, however, utilize robots for certain painting operations, and expect wider use in the near future.

The design complexity of future products shall certainly increase the present trend, whereby much of what we produce is conceived and planned by highly skilled and experienced personnel. The new graduate of a vocational school, or the retrained worker will utilize his or her own skills, but will also be guided by procedures established by others. As the technician gains in knowledge and experience, increased responsibility in the decision-making process will follow.

What kind of people do we need to support the future as described? I believe that we must first reemphasize a basic, underlying structure of skills before a student is permitted to specialize in a particular field. For instance, a grade 10 level of study should present an overview of industry as a whole, highlighting the opportunities that exist now, as well as those likely in the future. Along with this, we continue the educational process to (1) Develop mental

capacity, logical thinking, and motor skills. (2) Produce a recognition of the importance of conscientious attitudes, cooperation, and safe work habits. (3) Inspire each student to consider a career area and develop a willingness to make necessary sacrifices in order to become skilled in it. (4) Motivate a curiosity about technology and the world in general that will continue after graduation.

For those about to enter a retraining program, the key factor is motivation, as this person is most likely operating under more significant constraints than the younger student.

Once a student has become knowledgeable enough to choose a field, we can concentrate the educational effort toward a more specific goal. However, it is both unwise and potentially wasteful to specialize to an extreme today, and to ignore relationships with other disciplines. The key word here is *flexibility*.

The rapidly increasing pace of technological change can virtually wipe out a highly specialized skill overnight. The highest potential can be recognized in the student who has gained the most, overall, about a subject . . . not the student willing to spend the most hours polishing some accurately convoluted compound of iron, carbon, and other ingredients to a mirror finish!

Those of you intimately involved in vocational education will be serving two distinct audiences, particularly as we progress further into the eighties. In a sense, the existing worker in the retraining mode is probably much closer to the sharp edge of capabilities, and will require a shorter and more focused training period. This individual may also have the obvious advantage of a guaranteed job, and a greater oppor-

tunity to advance in skill, given the vested interest of the employer.

In many "mature" manufacturing industries across the nation, retraining will become a major issue in the years ahead. As many such employees are (and will continue to be) represented by labor unions, another issue arises — that is, labor/management cooperation in the retraining effort. At Mack Trucks, both parties recognized this necessity during our last contract negotiations with the United Auto Workers. We established three executive-level committees designed to discuss and develop mutually beneficial policies on (1) retraining and placement, (2) the impact of technological progress, and (3) employee involvement. We provide tuition refund programs for employees, which will no doubt represent a considerably higher expense in the future . . . hopefully to be offset by improvements in productivity.

The $3.6 billion Job Partnership Training Act, which went into effect on October 1st, is targeted for adult retraining programs for laid-off and other unemployed workers who require skill updating or modification. Such programs are being implemented with the cooperation of Private Industry Councils across the country. A local pilot program was launched two years ago in Lehigh County, Pennsylvania, and has been very successful.

Recent projections claim that perhaps 75 percent of the present work force will remain in place over the next ten years, and many in that group will require retraining. If this premise is valid, retraining may become necessary for reasons other than technological advancement. In a relatively static employment situation, with limited promotional opportunities, the lateral move-

ment of employees into other disciplines may become necessary as an incentive for them to continue their employment with us.

And still another labor issue arises: given the overriding concern of many unions for *preserving existing jobs,* what kind of cooperation can we expect in helping new workers who are trying to enter the job market, and given the rigidity of certain work rules, can the imperative of *vocational flexibility* become a reality?

I believe that our primary focus today still concerns the young people destined for high schools and technical schools. This is the heart of vocational education, this is where we can best address the enormous problem of youth unemployment, this is where so many changes must occur. The world of vocational education is a world of both pleasant surprises and bitter disappointments. It is an inconsistent world, in which some of the finest examples are juxtaposed with the worst.

Without ample mental resources, today's 18 year olds forfeit their chance for high salaries and interesting work. As never before, complex equipment, baffling technical manuals, and work with numbers drive the everyday lives of industrial and office workers. Solid foundations in language, mathematics, and science are basic to getting and holding these jobs.

Today, almost 20,000 high schools, career centers, technical institutes, and community colleges enroll some 17 million students in hundreds of different vocational programs. Many turn out highly employable technicians in growth-oriented fields. Many others have become human junkyards where the poorly prepared "do their time" waiting for a meaningless diploma that is nothing more than a ticket to the unemployment office.

Employers today cannot be expected to retrace the entire educational process when they find that prospective employees can neither read nor master basic processes and procedures.

Vocational education has great merit when a solid grounding in language and math is a prelude to hands-on training in a particular skill. But the skill must be *marketable*. What a tragic waste when students learn to rebuild carburetors as new automobiles are fuel-injected; when students pull down their dark plexiglass hoods and light welding torches as robots take over all but the most specialized of such operations; when 16 year olds sit and peck at manual typewriters as word processing and computer terminals revolutionize the office.

By many accounts, the biggest problem area involves the all-purpose public high schools often short on qualified teachers, relevant equipment, and rigorous standards. Consequently, all of their emphasis falls on academic education, while slow or reluctant pupils are prematurely pushed into poorly administered "job-training" courses.

Clearly, much of our vocational education programs in America must be *moved out of the high school basements!* Regular high schools might best serve vocationally oriented students by narrowing nonacademic instruction to a few well-chosen basic courses, such as typing, introductory computer science, and basic electronics. Once students master fundamentals, they could move on to full-time trade schools or technical institutes.

About four weeks ago, I had the privilege of attending a national conference on vocational education in Washington sponsored by the U.S. Department Of Education. The primary purpose of this gathering was to

discuss and react to the report just issued by the National Academy Of Sciences entitled, *"Education For Tomorrow's Jobs,"* which was commissioned by the department. This report is *must reading* for everyone involved in vocational education, and can be considered vocational education's equivalent of *"A Nation At Risk."*

Many specific conclusions and recommendations emerged from this in-depth evaluation of our nation's vocational programs. I intend to identify three that I feel are the most basic and most telling. First of all, there is absolutely no doubt that vocational education in America suffers from being conferred generally lower status than academic education, particularly at the high school level.

This perception among governmental agencies, school districts, and the public at all levels frustrates funding efforts as well as the recruitment of high quality personnel. The problem is often partially overcome in the specialty vocational high schools and post-secondary technical institutes, but what about those who never reach such programs?

A rapidly changing world and national economy demands a new type of work force, possessing a level and range of skills different from past generations. These skills are not taught in the college classroom. They are a function of vocational education. The problem of designing such programs to meet these changing skill requirements is that there is no agreement on what these requirements may be in the future. However, it is possible to chart apparent and emerging trends. And it is possible to better prepare students with basic strengths and with a wider exposure to promising areas, which will enable the student to adapt and

become a flexible, productive participant in this economy.

Most people would agree with the first point, as the supporting evidence is all around us. The *second* may provoke some debate. The Committee On Vocational Education And Economic Development In Depressed Areas firmly believes, and I agree, that providing an effective array of vocational education opportunities *is a role of public education equal in importance to their role of preparing students for college.*

While expanded efforts at collaboration between the public and private sectors *are certainly desirable,* employers *should not* be expected to assume greatly increased responsibility for education and training. The economics would be prohibitive, with only the largest firms able to do any substantial training. These trained people would then become marketable, and other firms would compete to hire them, thus destroying the original incentive to train and destroying the training firm's ability to recoup its investment. Furthermore, if only a handful of private entities offered training, they would most likely retain the graduates for *their own operations,* which would dramatically worsen the already critical problem of access.

As I said, the primary responsibility of public education does not preclude cooperative ventures and assistance from the private sector.

Business and labor organizations can often serve as effective catalysts, providing guidance on employment outlook, curricula, and standards; making up-to-date equipment and technical assistance available; establishing co-op and work/study programs; and creating competency-based evaluations. In fact, business and labor must

become *more involved* in making commitments of people and equipment, and in speaking out forcefully on scholastic shortcomings. This interest must reach beyond what comes easy — such as making tax-deductible donations and promising to hire more local graduates. But to burden us with the function of remedial training, or to expect us to hire students who have not mastered basic educational and occupational skills is to doom the whole system to failure.

The third and perhaps the most important conclusion concerns strengthening the actual practice of vocational education itself, in the areas of teaching, financing, and access.

The great *variety* that exists today in American vocational education is *both an asset and a drawback,* particularly as it affects the instructor. Certification requirements are set at the state and local levels, with extreme variation across the country. Public high school instructors often cannot apply occupational training experience gained in business to the requirements that exist, a desirable option that seems limited to the post-secondary level.

On the other hand, many instructors are plucked out of industrial situations and are expected to teach with little or no human relations skills. A widespread parallel exists in business, when individuals are taken off a production line and proclaimed supervisors.

These points and more point to the need for *federal guidelines* on competency-based certification, in-service training, incentives to promote periodic updating of instructor knowledge and skills, and a formula aimed at rewarding excellence.

Some may balk at the prospect of further federal involvement in education. But given

the tremendous impact that quality vocational training can have on our future as a nation, I believe such involvement, which would still be comparatively limited, is fully justified.

The issues of funding and access are closely related, and traditionally controversial. Vocational program costs are highly variable, highly dependent upon the type of equipment required, and highly susceptible to rapid change. Local capitation formulas (number of dollars per student) limit flexibility and *frustrate* programs that involve attendance at more than one facility. New formulas should take more of the commonplace variables into account, including the needs for remedial training and the needs of disadvantaged students.

Also, several programs or schools should be permitted to pool their resources of expensive equipment that is purchased, leased, or borrowed. And experimental programs that may lead to entire new avenues of training must be encouraged with seed money and administrative support.

The committee has recommended the selective introduction of *Vocational Incentive Grants* on a *trial basis.* Such a system would provide grants to institutions on behalf of students between the ages of 14 and 18, scaled to the individual's economic resources. The grants would be used to obtain vocational training anywhere in the country, providing a maximum value of 100 - 120 percent of the national average expenditures per student in secondary vocational education programs. Students could use the grants any time during their four years of eligibility and for sufficient time to complete their programs.

The committee recognizes, and *I* recognize that such new approaches are likely to

meet with strenuous opposition from various sources, but experimentation is warranted if it will help to improve the programs and students' access to them. If we are not open to new ideas, we might ask ourselves, "why are we here?"

I am confident that we all share the belief that some rather substantial changes must come to vocational education. But we must resist the simple answers that do not solve problems — they only prolong their resolution. We must reexamine the entire underlying structure of our education system, and resist the temptation to throw more money at the problems with the hope that it will somehow provide a fix. Despite comments to the contrary from several media-prominent education figures, the answer does not lie in simply paying teachers more.

As most of you are aware, the $700 million Vocational Education Act, one of the federal government's largest subsidies to secondary education, expires on September 30, 1984. The same recent studies that have brought education to the front pages have also suggested to congress that existing programs are not working — particularly in vocational education. This measure will face a real struggle, regardless of the fact that 1984 is an election year, and regardless of the fact that news often attracts money. Furthermore, vocational education for America's youth has reached the critical stage *simultaneously* with the plight of displaced workers.

Vocational planners have a unique opportunity to get started on some long overdue reforms, and the opportunity is *now!*

In concluding my remarks I would like to review the recommendations of James T. Allison, Program Manager For Industrial, Apprenticeship, And Health Education,

California State Department Of Education:

- We need national program standards developed jointly with industry and education, both general and specific for areas within trade and industry.
- We must coordinate programs and training in grades 7 through 14 (grades 7 through the first two years of post-secondary training).
- Industry and education must jointly share the *decision making, planning,* and *implementation* processes.
- We must adjust academic training to better reflect changing technology.
- The time allotted for complete training should increase proportionally with the complexity of the subject matter.
- We must encourage a regular exchange of personnel between training and industry on a short duration basis to ensure relevance to current and anticipated needs.
- We must encourage more cooperative programs that include both classroom and on-the-job training, perhaps after regular hours. This measure addresses the fact that it is financially impossible for schools to stay fully up-to-date with industrial equipment.
- We must end the practice of "turfmanship" with training programs, and substitute cooperation among all segments.
- Training is incomplete without the personal skill development, motivation, and leadership programs provided by organizations such as VICA. The crucial importance of this added dimension cannot be underestimated.

I personally support each and all of these recommendations.

As chairman of VICA's Youth Development Foundation Sponsoring Committee, and in keeping with the theme of your convention — "Vocational Education And Business: A Working Partnership," I will do everything in my power to encourage business and industry leaders to accept their responsibilities in this regard. And I urge our other partners, namely government, labor, and education to accept and pursue their roles.

The challenge is so similar to that presented to our country by global economic transformation. And the interest that hangs in balance is precisely the same — our national interest, and the human dignity of our citizens.

Thank you very much!